

CLAIMS:

1. A recombinant polypeptide comprising a delta-9 desaturase enzyme from a prokaryote in operable linkage
5 with an endoplasmic reticulum retention and retrieval signal sequence.
2. The recombinant polypeptide of claim 1, wherein said prokaryote is a bacterium.
3. The recombinant polypeptide of claim 1, wherein
10 said prokaryote is a cyanobacteria blue-green alga belonging to a genus selected from the group consisting of *Anacystis*, *Synechocystis*, and *Anabaena*.
4. The recombinant polypeptide of claim 3, wherein said cyanobacteria is *Anacystis nidulans*.
- 15 5. The recombinant polypeptide of claim 1, wherein said delta-9 desaturase enzyme comprises:
 - (a) a polypeptide having the amino acid sequence set forth in SEQ ID NO:2;
 - (b) a variant or homologue of the polypeptide defined in
20 (a) having at least 50%, 60%, 70%, 75%, 80%, 85%, 90%, or 95% identity thereto and having delta-9 desaturase activity; and
 - (c) a fragment of the polypeptide defined in (a) having at least about 50 contiguous amino acids identical thereto
25 and having delta-9 desaturase activity.

6. The recombinant polypeptide of claim 1, wherein said delta-9 desaturase has the amino acid sequence set forth in SEQ ID NO:2.

7. The recombinant polypeptide of any one of claims 1 to 6, wherein said endoplasmic reticulum membrane retention and retrieval signal has an amino acid sequence selected from the group consisting of:

(a) KDEL (SEQ ID NO:4);

(b) KKXX (SEQ ID NO:3), where X is any amino acid;

10 (c) HDEF (SEQ ID NO:6);

(d) KEEL (SEQ ID NO:7); and

(e) KDQL (SEQ ID NO:8).

8. The recombinant polypeptide of claim 7, wherein said endoplasmic reticulum membrane retention and retrieval signal has the amino acid sequence KKSS (SEQ ID NO:5).

9. A nucleic acid molecule encoding the recombinant polypeptide defined in any one of claims 1 to 8.

10. A vector comprising the nucleic acid molecule of claim 9 in operable linkage with a promoter.

11. A host cell transformed with the vector of claim 10.

12. The host cell of claim 11 that is derived from an oil seed plant.

13. The host cell of claim 12, wherein said oil seed plant is selected from the group consisting of canola, soybean, corn, peanut, sunflower, olive, palm, coconut, safflower, cottonseed, mustard, sesame, hemp, castor, avocado and flax.
14. The host cell of claim 12 wherein said oil seed plant is canola.
15. A transgenic plant cell comprising a transgenic element containing the nucleic acid molecule of claim 9 in operable linkage with a promoter which effects expression of the recombinant polypeptide in said transgenic plant cell.
16. The transgenic plant cell of claim 15 that is derived from an oil seed plant.
17. The transgenic plant cell of claim 16, wherein said oil seed plant is selected from the group consisting of canola, soybean, corn, peanut, sunflower, olive, palm, coconut, safflower, cottonseed, mustard, sesame, hemp, castor, avocado and flax.
18. The transgenic plant cell of claim 16, wherein said oil seed plant is canola.
19. A method of making a transgenic plant comprising:
- (a) transforming a plant cell with the nucleic acid of claim 9, or a vector comprising such nucleic acid, wherein said nucleic acid is in operable linkage with a promoter which effects expression of the recombinant polypeptide in said plant cell; and

(b) regenerating a plant from the transformed plant cell produced in step (a).

20. The method of claim 19, wherein said plant cell is derived from an oil seed plant.

5 21. The method of claim 20, wherein said oil seed plant is selected from the group consisting of canola, soybean, corn, peanut, sunflower, olive, palm, coconut, safflower, cottonseed, mustard, sesame, hemp, castor, avocado and flax.

10 22. The method of claim 20, wherein said oil seed plant is canola.

23. A transgenic plant comprising a transgenic element containing the nucleic acid molecule of claim 9 in operable linkage with a promoter which effects expression
15 of the recombinant polypeptide in said transgenic plant.

24. The transgenic plant of claim 23 that is an oil seed plant.

25. The transgenic plant of claim 24, wherein said oil seed plant is selected from the group consisting of
20 canola, soybean, corn, peanut, sunflower, olive, palm, coconut, safflower, cottonseed, mustard, sesame, hemp, castor, avocado and flax.

26. The transgenic plant of claim 24, wherein said oil seed plant is canola.

25 27. The transgenic plant of any one of claims 23 to 26 that produces oil having a reduced saturated fatty acid

content as compared to a wild-type plant of the same species.

28. The transgenic plant of claim 27, wherein the saturated fatty acid content of said seed oil is reduced by about 10%, about 15%, about 20%, about 30%, about 40% about 50% or more as compared to said wild-type plant.

29. Use of the transgenic plant of any one of claims 23 to 28 for producing seed oil having a reduced saturated fatty acid content as compared to a wild-type plant of the same species.

30. The use of claim 29, wherein the saturated fatty acid content of said seed oil is reduced by about 10%, about 15%, about 20%, about 30%, about 40% about 50% or more as compared to said wild-type plant.

31. The use of claim 29, wherein said transgenic plant is canola.

32. The use of claim 31, wherein said seed oil has a saturated fatty acid content of less than about 7 mol %.

33. The use of claim 31, wherein said seed oil has a saturated fatty acid content of about 4.0% to about 4.5%.